Biological Data on Arctic Charr, *Salvelinus alpinus* (L.), from the Rat River, Northwest Territories, 1983

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ABSTRACT

GILLMAN, D.V., and P.D. SPARLING. 1985. Biological data on Arctic charr, Salvelinus alpinus (L.), from the Rat River, Northwest Territories, 1983. Can. Data Rep. Fish. Aquat. Sci. 535: iv + 15 p.

The annual migration of Arctic charr to spawning and overwintering grounds on the Rat River provides the focus for an important domestic fishery for residents of Aklavik and Fort McPherson, Northwest Territories. Biological data (age, length, weight, sex, maturity, fecundity, condition) for Arctic charr captured by a fish weir and trap on the Rat River during 1983 are presented in this report. A total of 1 312 charr were captured during August 1983 of which 752 were spawners and 560 were non-spawners. Enumeration of the 1983 upstream migration was incomplete since high water levels damaged the weir. Charr sampled had a mean length of 413 mm, mean round weight of 1 008 g and a mean age of 7 years.

Key words: age composition; domestic fishing; fish weir; trap nets; migrations; tagging; sexual maturity; size distribution; spawning.

RESUME

GILLMAN, D.V., and P.D. SPARLING. 1985. Biological data on Arctic charr, Salvelinus alpinus (L.), from the Rat River, Northwest Territories, 1983. Can. Data Rep. Fish. Aquat. Sci. 535: iv + 15 p.

La migration annuelle des ombles chevaliers vers leurs frayères et lieu d'hivernage sur la rivière Rat permet aux résidents d'Aklavik et de Fort McPherson (Territoires du Nord-Ouest) de pratiquer une pêche familiale importante. Le présent rapport contient les données biologiques (âge, longueur, poids, sexe, maturité sexuelle, fécondité, condition) sur des ombles chevaliers capturés, à l'aide de bordigues et de filets-trappes, dans la rivière Rat au cours de l'année 1983. Un nombre total de 1 312 ombles chevaliers furent pris en août 1983, dont 752 frayant et 560 ne frayant pas. Le dénombrement de la population qui a remonté la rivière est incomplet étant donné que la crue des eaux avait endommagé la bordigue. Les poissons échantillonnés mesuraient en moyenne 413 mm, pesaient en moyenne 1 008 g et étaient âgés en moyenne de 7 ans.

Mots-clés: composition par âge; pêche familiale; bordigue; filet-trappe; migrations; étiquetage; maturité sexuelle; répartition par taille; frai.

INTRODUCTION

Traditionally, a domestic fishery for anadromous Arctic charr has been carried out along the western Mackenzie Delta by residents of the local communities of Aklavik and Fort McPherson. However, during the last 20 years the resource has also been commercially exploited (Bissett 1967; Corkum and McCart 1981). At present the annual commercial quota for the Mackenzie Delta is 900 kg. The principal stocks being harvested by the domestic and commercial fisheries originate from the Big Fish and Rat River systems (Corkum and McCart 1981) but due to insufficient information on the seasonal distribution of these stocks commercial quotas for the individual systems have not been instituted (A.H. Kristofferson, Department of Fisheries and Oceans, Western Region, Winnipeg, MB, personal communication).

Growing community population levels have placed increased demands on these stocks. Recently requests have been made to the Department of Fisheries and Oceans (DFO) by area hunters and trappers associations and local fishermen to determine the appropriate harvest levels and to assess the abundance and distribution of charr stocks in the western Mackenzie Delta. As a result of these requests a study was initiated on the Rat River in 1983 to collect the required data to answer these questions. This report presents the data collected to date.

STUDY AREA

The study area is shown in Fig. 1. The Rat River is located 90 km southwest of Inuvik and flows eastward from the Richardson Mountains to the southwest corner of the Mackenzie Delta (Fig. 2). Approximately 93 km in length from source to the outlet into the Husky Channel (67°46'N, 135°03'W), the Rat River drains an area of 1 680 square km. Topography is variable with rugged mountains in the upper area, rolling foothills in the central portion, and in the lower area low-lying spruce muskeg typical of the Mackenzie Delta. A complete description of vegetation cover and topography is available from Rowe (1972). Typical of short mountainous drainages the Rat River is subject to extreme variations in daily water levels (±2 m) during the spring runoff and following periods of heavy rainfall (Hydrological Survey of Canada 1983). The three main tributaries of the Rat River are Fish Creek, Bear Creek and the Longstick River (Fig. 3). All are located in the upper and central sections of the river. Physical characteristics and flow rates also vary within the three topographic areas. In the mountainous area the river is narrow (1-4 m), shallow (0.5-1 m), and meanders through a wide (0.5-1 km), steep-sided valley. Substrate and shoreline consist of gravel and medium size cobble (10-50 mm) with a few large boulders. The water is clear and clean. Within the foothills region the valley widens (1-2 km) and the river varies from a swift-flowing single channel within a steep gorge to a wide gravel flood plain with many small channels throughout. Substrate and shoreline are similar to that found in the mountainous area. However, turbidity increases slightly resulting from the inflow of a number of small feeder streams. Upon leaving the foothills area the river narrows into a single channel of medium width (4-5 m) and depth (1-4 m). The flows are reduced as the river courses through a series of meanders to the outlet at the Husky Channel. Substrate and shoreline are comprised of silt, sand, and mud. Silt loads gradually increase in the lower reaches of the Rat River and waters in the delta portion are turbid. This lower portion is the only section of the river that is navigable to motorized vessel traffic. Fish species occurring in the Rat River are identified by Jessop et al. (1973).

PREVIOUS STUDIES

Biological data on Arctic charr populations in the Mackenzie Delta area are limited. However, historical references to the charr and whitefish food fisheries in the Delta region were made by explorers, traders, missionaries, and RCMP post members. Bissett (1967) provides a brief overview of fishing techniques and the extent of all fisheries occurring in the Delta prior to and during the early 1960's. Jessop et al. (1973), during a synoptic watershed survey of the Mackenzie River Valley in 1972 and 1973, collected biological data from the Rat River. Domestic and commercial harvest statistics were collected by DFO in 1973 (DFO, 501 University Cres., Winnipeg, MB, unpublished data). Additional harvest data were collected from 1973 to 1980 by the Government of the Northwest Territories (GNWT), Wildlife Service, utilizing community questionnaires and interviews of local area residents (GNWT Wildlife Service, Yellowknife, NWT, unpublished data). Corkum and McCart (1981) summarize the domestic and commercial harvest for all fish species in the Mackenzie Delta from 1960 to 1980 and identify a requirement for additional detailed harvest studies. During 1981 DFO conducted a domestic fishery survey in the Mackenzie Delta and collected samples of Arctic charr from the Rat River from 1981 to 1984 for fish disease investigations. Data from these efforts are on file at the Freshwater Institute, 501 University Crescent, Winnipeg, Manitoba. A summary of domestic and commercial fishing efforts and Arctic charr harvest statistics from 1960 to 1981 (Corkum and McCart 1981) with supplemental data from the above sources appears in the Appendix.

THE FISHERY

Arctic charr in the Mackenzie Delta are anadromous, summering in the Beaufort Sea and wintering in freshwater systems. Annual migrations to freshwater begin in early August as charr move into the Mackenzie Delta from the Beaufort Sea to spawning and wintering grounds. Throughout the six week migration period Arctic charr are exploited by both the domestic and commercial fisheries. Traditional domestic fishery locations for Arctic charr are as follows: Shingle Point; the mouth of the Big Fish River; Fish Hole on Cache Creek; the Aklavik townsite area; the mouth of Husky Channel; Big Eddy; the mouth of the Rat River; Destruction

City; and at the fish holes in Fish Creek (Fig. 2). Commercial catches are taken in conjunction with the domestic effort. Primary commercial locations are the mouth of the Big Fish River, Aklavik townsite area, and the mouth of the Rat River (Fig. 2). Charr are harvested from the individual fishing locations for approximately a two week period in accordance to their position on the migration route.

The majority of charr fishermen are residents of either Aklavik or Fort McPherson. Charr taken for domestic purposes are either dried, smoked or eaten fresh. Charr for commercial use are frozen and transported to Inuvik, Aklavik and Fort McPherson for local sale. Culled charr and incidental species from both fisheries are used as dog food.

METHODS AND MATERIALS

FISH WEIR

An aerial and ground survey was conducted on 2 August 1983 on the Rat River and a weir site selected (Fig. 3). On 8 August a fish weir and upstream fish trap were constructed at this location. The weir and trap remained in operation until 30 August at which time high water levels caused it to collapse.

Weir construction was of prefabricated aluminum and steel design (Anderson and McDonald 1978). Each section consisted of two 3 m lengths of 5 cm channel iron with 1.5 cm holes drilled at 1.5 cm intervals. Galvanized conduit pipe, 1.5 cm x 1.6 m, was inserted vertically to complete the construction of each section. Individual sections were bolted to upright steel pipes and supported with 2.5 m wooden "A" frames anchored to the stream bottom with burlap bags filled with rocks. Sections of the weir were joined at the steel uprights. Approximately 45 m of conduit fencing was utilized and an additional 35 m section of plastic netting (2.4 cm mesh) supported with steel snow fence stakes and sandbags was necessary in shallow inshore areas to complete the weir construction. The trap consisted of a wood frame and aluminum conduit cage 1.2 m x 2.4 m x 1.7 m in height, located at the apex of the weir (Fig. 4).

Sandbags and rocks were used to anchor the trap in the stream and sections of plastic netting (2.4 cm mesh) were utilized to join the trap to adjoining weir sections.

Fish entering the trap were identified as to species and enumerated. Arctic charr captured each day were either enumerated and released, tagged and released, live sampled for length and released, or sacrificed for biological sampling (dead sampled).

A reference water level was noted on 8 August and daily water levels were subsequently recorded. Surface water temperatures were recorded daily using a Wahl Model 10 digital thermometer.

TAGGING

Approximately 24% of all Arctic charr enumerated were tagged. Floy (spaghetti) tags were applied using a Dennison Model FDM-68 tagging gun. Tags were inserted just under the dorsal fin and anchored behind the basal pterygiophores. Fork length (±1 mm) was recorded from all tagged fish. Tagged fish were held in a retaining facility for a short observation period prior to being released. A reward was offered for all returned tags.

BIOLOGICAL INVESTIGATION

Forty-six percent of the charr enumerated were live sampled for fork length (±1 mm), sexed by external examination as described by McPhail and Lindsey (1970), and released upstream. Validation of external identification for sex and maturity was done by dead sampling 20 charr and examining the gonads. Non-spawners and immature fish exhibit no secondary sexual characteristics and could not be externally sexed.

At the request of local native groups the number of sacrificed fish was minimized by selective biological sampling of captured charr. This was attempted by sampling 10 charr from each 50 mm length interval within the range of the fish captured. As fewer fish were captured at the extremes of the range samples were incomplete for some intervals. Therefore only 7% of the Arctic charr enumerated were dead sampled for fork length (±1 mm), round weight (±25 g), sex, age (otolith), and maturity. Maturity was determined by gross examination of the gonads (Appendix 1). Both sagittal otoliths were taken for age determination and stored dry in coin envelopes marked with the sample information. Age determination was conducted in the laboratory by grinding the convex surface of the otolith on a fine carborundum stone to expose the annual growth zones. Otoliths were then cleared in a solution of benzyl-benzoate, placed in a depression slide, and the annual growth zones read under a dissecting microscope (x30).

Fecundity information collected from the 21 dead-sampled female charr included ovary weight (±1 g) and length (±1 mm) and a total egg count of each ovary. Five groups of 20 ova each were measured to determine average ovum size. Taxonomic identification of Arctic charr from the Rat River followed McPhail (1961), utilizing gill raker and pyloric ceaca counts from 12 dead-sampled charr.

As part of a survey of Arctic charr stocks in the Mackenzie Delta region for infectious pancreatic necrosis (I.P.N.) virus, the Rat River population has been sampled annually since 1981. During this study blood, tissue, and organ samples were collected from 20 dead-sampled charr according to methods described by Souter et al. (1984). Analysis of the samples is being conducted at both the Microbiology Section, University of Alberta, and the Freshwater Institute, DFO, Winnipeg, Manitoba. Preliminary findings are presented by Souter et al. (1984).

Condition factor (K), a measure of the plumpness of the charr, was calculated using the following equation:

$$K = \frac{W \times 10^5}{L^3}$$

where W = weight in grams
L = fork length in millimeters

Data collected were analyzed using an Amdahl 5850 computer. The Statistical Analysis System (1982) was used to generate length, weight, age, sex and maturity summaries and to perform basic calculations. Some additional calculations were performed using a Hewlett-Packard programmable calculator (Model 9810-A).

RESULTS

ENUMERATION

The weir was in operation for 23 days from 8 August to 30 August. Enumeration of the migration was incomplete as trap installation occurred subsequent to the advent of the run and high water levels forced the removal of the weir prior to completion of the run. A total of 1 312 Arctic charr entered the trap of which 752 (57%) were externally identified as current year spawners. Sex ratio favored females 4:1.

Daily water temperature fluctuated showing an overall decline throughout the study period (Fig. 5). It appeared to have little influence on fish movements. Daily water levels declined steadily from datum on 8 August until 23 August then rose sharply on 24 August due to heavy rainfalls (Fig. 5).

Daily mean fork length remained stable from 8 August to 25 August then declined sharply on 27 August (Fig. 6). The daily count increased from 8 August to 30 August (Fig. 6).

BIOLOGICAL INVESTIGATION

The length-frequency distribution for all Arctic charr captured from the Rat River fish weir during 1983 is shown in Fig. 7. Modal length was 300-349 mm with a mean length of 413 mm (Table 1). Length frequency distributions for live sampled and released, tagged and released, and dead-sampled portions of the total catch are shown in Appendices 2, 3 and 4.

Biological data by age group for Arctic charr (dead sampled only) from the Rat River in 1983 are shown in Table 2. Modal age was 6 years for males, 7 years for females, and 7 years for sexes combined. Mean age was 7 years. Age at first maturity appeared to be 5 years.

As samples were obtained from selected length intervals age data in Table 2 are not considered representative of the Rat River population.

Gillraker counts ranged from 21 to 23 with a mean count of 21.8 (Table 3). Pyloric caeca counts ranged from 23 to 44 lobes with a mean count of 31.2 lobes per fish (Table 3). These data correspond to McPhail's (1961) description of the eastern Alaskan form of Arctic charr nominally found within and west of the Mackenzie Delta in Canada.

Fecundity data are presented in Table 4. Mean total egg count was 4 221 (range 1 783 to 8 395). Mean egg size was 3.68 mm (range 2.85 to 4.26 mm).

ACKNOWLEDGMENTS

The authors would like to thank the Fort McPherson and Aklavik Hunters and Trappers Associations for their assistance and cooperation throughout the survey. Summer staff R. Haraga and R. Holland are thanked for their participation in the project. Mr. R. Barnes and Mr. W. Kowalzyck, Fisheries Officers, Inuvik District Office, contributed to the success of the program and furnished harvest data. Mr. G. Carder determined the ages of the charr sampled and figures were prepared by Graphics Services, Freshwater Institute. Typing was done by S. Ahlgren. M.M. Roberge reviewed and provided comments on an earlier draft of the report. K.T.J. Chang-Kue and A.H. Kristofferson reviewed the final draft.

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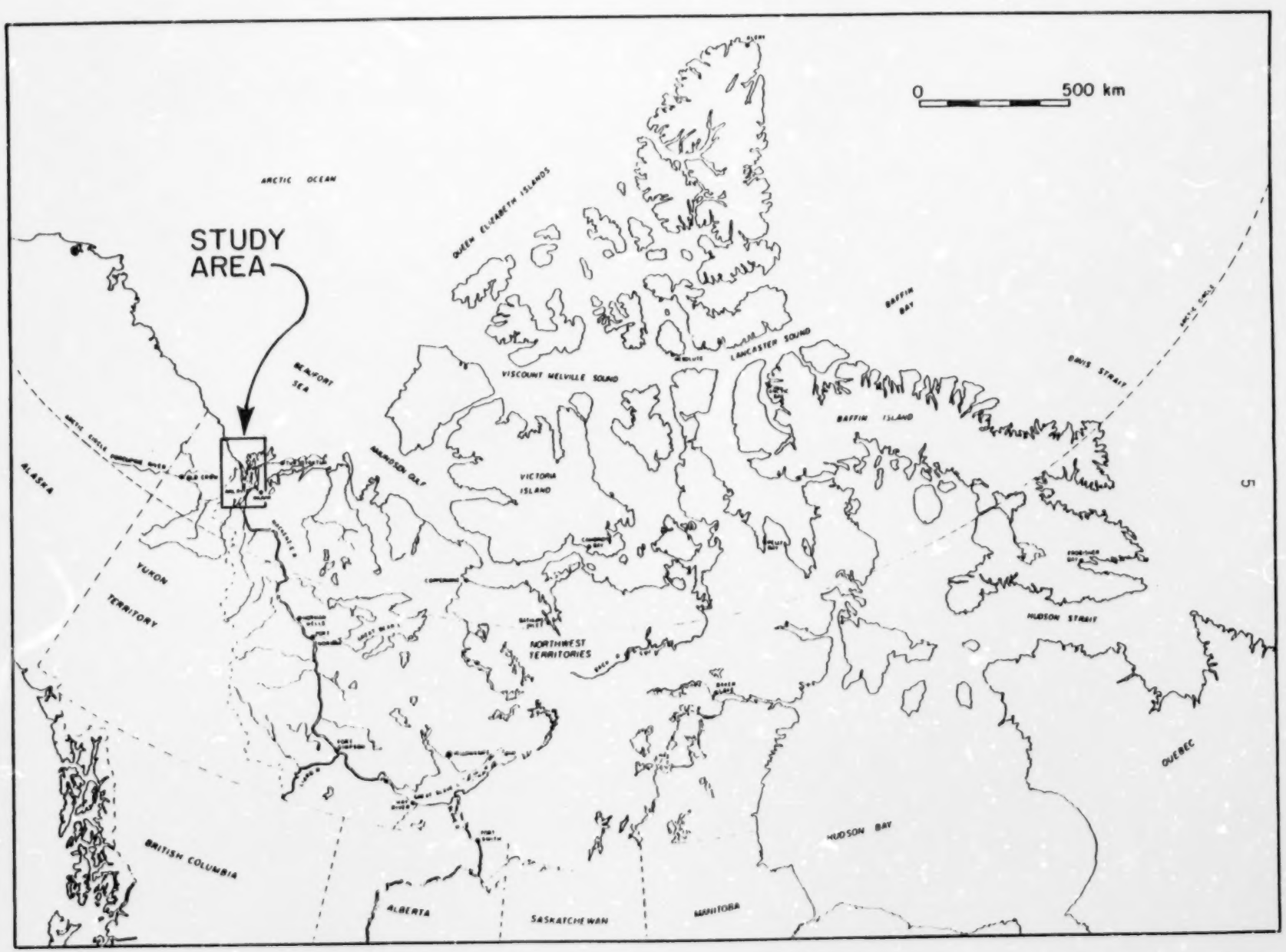

Fig. 1. Map of the Northwest Territories showing the location of the study area.

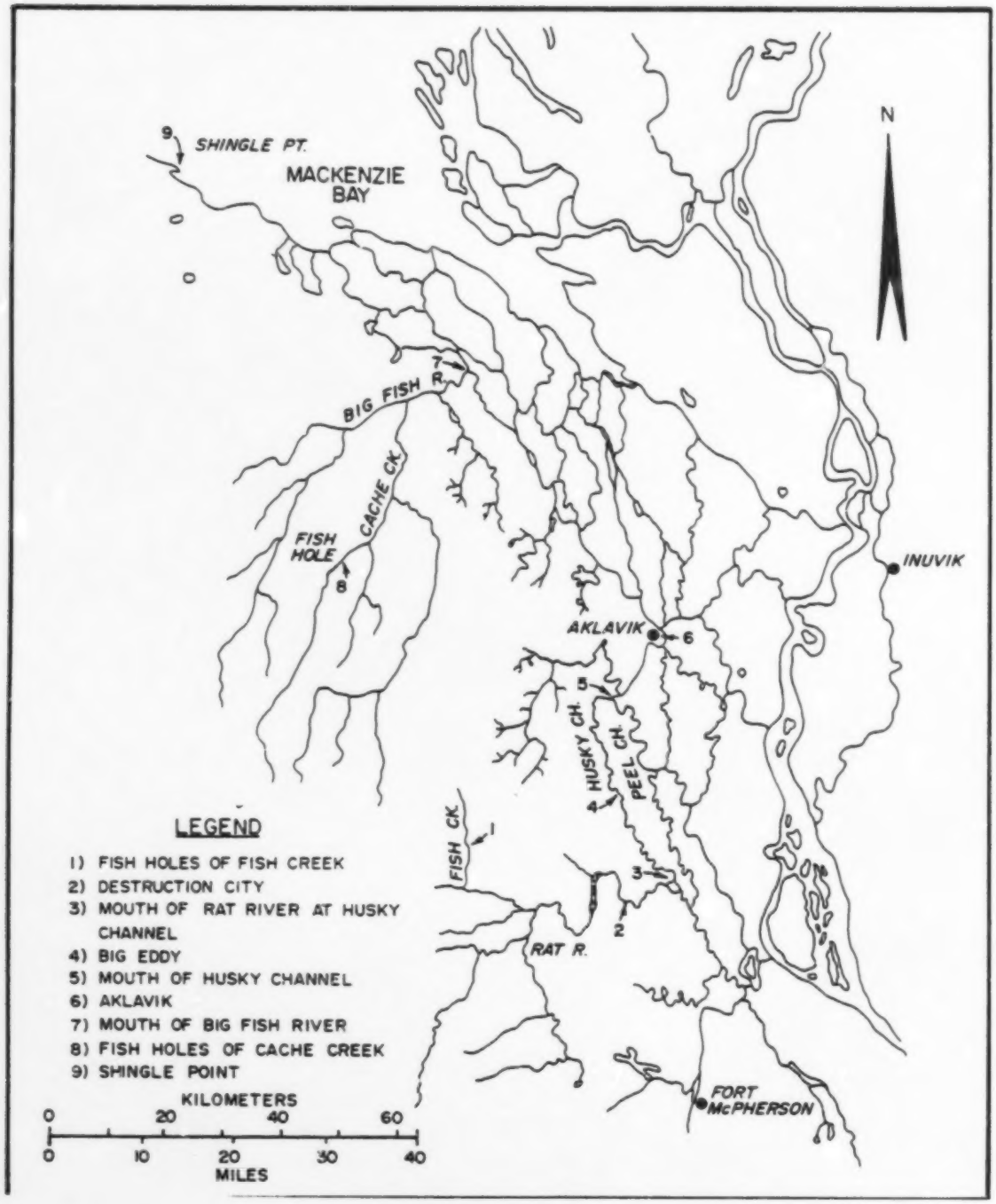

Fig. 2. Map of the Mackenzie River Delta showing domestic and commercial gillnetting sites.

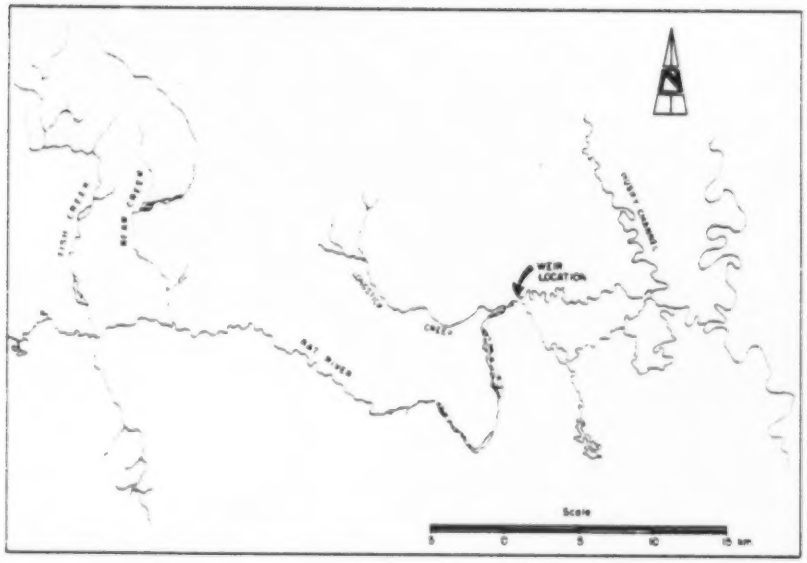

Fig. 3. Map of the Rat River showing the location of the fish weir and trap, 1983.

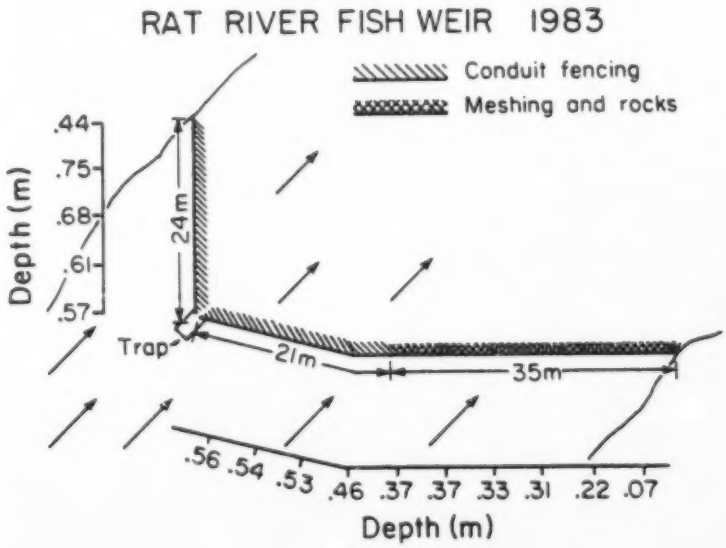

Fig. 4. A diagram showing water depth and construction details of the Rat River fish weir and trap, 1983.

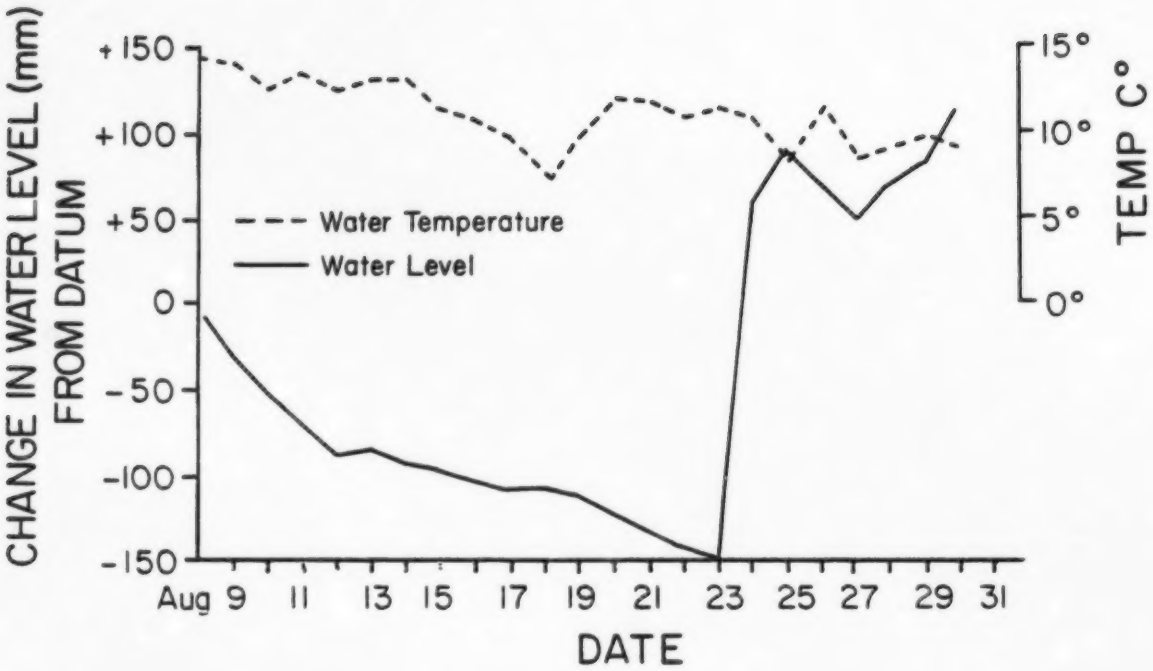

Fig. 5. Water level and water temperature by day for the Rat River fish weir, 1983.

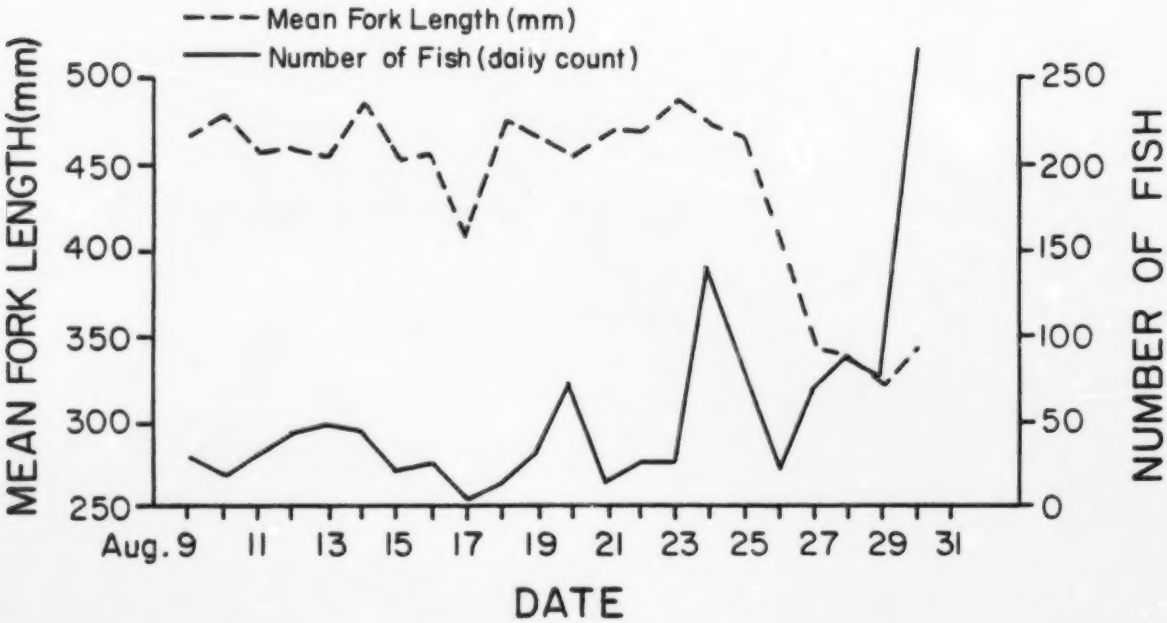

Fig. 6. Number by day and mean fork length of Arctic charr captured in the Rat River fish weir, 1983.

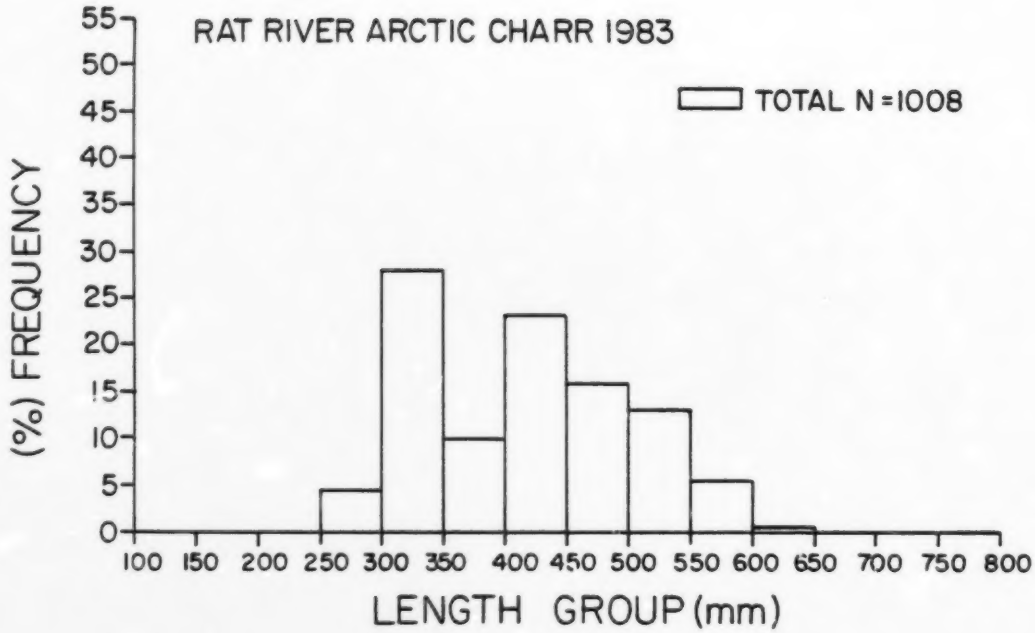

Fig. 7. Length-frequency distributions for Arctic charr captured in the Rat River, 1983.

Table 1. Biological data by length interval for all Arctic charr captured in the Rat River, 1983.

LENGTH INTERVAL (MM)	MALES N	MALES LENGTH(MM) MEAN	MALES WEIGHT(G) MEAN	MALES WEIGHT(G) SD	MALES K	MALES % MAT	FEMALES N	FEMALES LENGTH(MM) MEAN	FEMALES WEIGHT(G) MEAN	FEMALES WEIGHT(G) SD	FEMALES K	FEMALES % MAT	COMBINED N	COMBINED LENGTH(MM) MEAN	COMBINED WEIGHT(G) MEAN	COMBINED WEIGHT(G) SD	COMBINED K	COMBINED % MAT
250	1	298	255	-	0.96	0	5	294	274	40	1.05	0	44	292	270	36	1.03	0
300	3	328	404	20	1.15	33	16	318	370	96	1.13	0	282	320	376	86	1.13	0
350	9	392	-	-	-	0	36	385	600	96	1.11	11	101	378	600	96	1.11	4
400	27	421	683	161	0.98	7	132	422	847	97	1.09	11	233	421	819	121	1.07	7
450	31	470	1150	71	1.06	6	108	474	1222	201	1.13	18	159	473	1216	193	1.13	13
500	25	521	1325	35	0.98	8	92	522	1489	188	1.04	15	131	522	1469	184	1.04	12
550	14	573	1950	212	1.06	14	35	563	1863	75	1.02	11	54	566	1900	112	1.03	11
600	1	620	-	-	-	0	2	612	2400	-	1.01	50	4	614	2400	-	1.01	25
TOTAL	111						426						1008					
MEAN		472	951	581	1.04			461	1005	499	1.09			413	1008	515	1.09	

Table 2. Biological data by age group for Arctic charr dead sampled from the Rat River, 1983.

AGE (YR)	MALES N	MALES LENGTH(MM) MEAN	MALES LENGTH(MM) SD	MALES WEIGHT(G) MEAN	MALES WEIGHT(G) SD	MALES K	MALES % MAT	FEMALES N	FEMALES LENGTH(MM) MEAN	FEMALES LENGTH(MM) SD	FEMALES WEIGHT(G) MEAN	FEMALES WEIGHT(G) SD	FEMALES K	FEMALES % MAT	COMBINED N	COMBINED LENGTH(MM) MEAN	COMBINED LENGTH(MM) SD	COMBINED WEIGHT(G) MEAN	COMBINED WEIGHT(G) SD	COMBINED K	COMBINED % MAT
3	1	298	-	255	-	0.96	0	-	-	-	-	-	-	-	1	298	-	255	-	0.96	0
4	-	-	-	-	-	-	-	2	295	6.4	245	7	0.96	0	2	295	6.4	245	7	0.96	0
5	2	404	0.0	650	212	0.99	50	7	318	17.9	369	100	1.13	0	9	337	41.0	432	169	1.10	11
6	4	407	95.6	831	485	1.14	75	11	408	62.4	843	354	1.17	55	15	408	68.8	840	374	1.16	60
7	3	426	94.0	829	487	0.99	67	22	454	55.6	1083	388	1.11	82	25	451	59.3	1052	398	1.10	80
8	1	480	-	1100	-	0.99	100	8	499	39.3	1319	392	1.03	100	9	497	37.3	1294	374	1.03	100
9	-	-	-	-	-	-	-	7	497	35.9	1332	282	1.07	100	7	497	35.9	1332	282	1.07	100
10	1	555	-	1800	-	1.05	100	3	533	12.6	1450	278	0.96	100	4	539	14.9	1538	287	0.98	100
11	1	582	-	2100	-	1.07	100	1	619	-	2400	-	1.01	100	2	601	26.2	2250	212	1.04	100
TOTAL	13							61							74						
MEAN		433	94	951	581	1.04			442	81.1	1029	494	1.10			441	83.0	1016	507	1.09	
MEAN AGE	7.0																				

Table 3. Gillraker and pyloric ceaca counts for dead-sampled Arctic charr from the Rat River, 1983.

Sample No.	No. of Gillrakers			No. of Pyloric Caeca
	Upper Arch	Lower Arch	Total	
1	10	13	23	23
2	10	12	22	44
3	10	11	21	27
4	10	11	21	-
5	10	12	22	-
6	10	12	22	-
7	10	12	22	-
8	10	12	22	-
9	10	12	22	-
10	9	12	21	34
11	10	11	21	28
12	10	12	22	31
Range	9-10	11-13	21-23	23-44
Mean	10	12	22	31

Table 4. Synopsis of fecundity data obtained for dead-sampled Arctic charr from the Rat River, 1983.

	Length (mm)			Weight (g)			Egg count		
	n	mean	range	n	mean	range	n	mean	range
Left Ovary	20	230	128-305	21	89	20-249	21	2 091	650-4 444
Right Ovary	20	228	118-306	21	94	16-220	21	2 131	875-3 951
Combined	-	-	-	21	178	36-471	21	4 221	1 787 8 395

Appendix 1. A flow chart and code for the determination of the maturity stages of Arctic charr.

MATURITY FLOW CHART

IMMATURE — MATURE — RIPE — SPENT — RESTING

FISH MATURITY CODE

Maturity State		Female		Male
Immature (virgin)	1	- ovaries granular in texture - hard and triangular in shape - up to full length of body cavity - membrane full - eggs distinguishable	6	- testes long and thin - tubular and scalloped shape - up to full body length - putty-like firmness
Mature	2	- current year spawner - ovary fills body cavity - eggs near full size but not loose - not expelled by pressure	7	- current year spawner - testes large and lobate - white to purplish color - centers may be fluid - milt not expelled by pressure
Ripe	3	- ovaries greatly extended and fill body cavity - eggs full size and transparent - expelled by slight pressure	8	- testes full size - white and lobate - milt expelled by slight pressure
Spent	4	- spawning complete - ovaries ruptured and flaccid - developing oocytes visible - some retained eggs in body cavity	9	- spawning complete - testes flaccid with some milt - blood vessels obvious - testes violet-pink in color
Resting	5	- ovary 40-50% of body cavity - membrane thin, loose, and semi-transparent - healed from spawning - developing oocytes apparent with few atretic eggs - some eggs may be retained in body cavity	10	- testes tubular, less lobate - healed from spawning - no fluid in center - usually full length - mottled and purplish in color
Unknown (virgin)	0	- cannot be sexed - gonads long or short and thin - transparent or translucent		
Unknown (non-virgin)	11	- resting fish - has spawned but gonads regenerated - sexing not possible		

Appendix 2. Biological data by length interval for Arctic charr tagged and released in the Rat River, 1983.

LENGTH INTERVAL (MM)	MALES N	MALES %	MALES LENGTH(MM) MEAN	MALES WEIGHT(G) MEAN	MALES WEIGHT(G) SD	MALES K	FEMALES N	FEMALES %	FEMALES LENGTH(MM) MEAN	FEMALES WEIGHT(G) MEAN	FEMALES WEIGHT(G) SD	FEMALES K	COMBINED N	COMBINED %	COMBINED LENGTH(MM) MEAN	COMBINED WEIGHT(G) MEAN	COMBINED WEIGHT(G) SD	COMBINED K	% FEMALE
300	-	-	-	-	-	-	-	-	-	-	-	-	38	12	328	-	-	-	-
350	3	7	387	-	-	-	11	8	390	-	-	-	45	15	375	-	-	-	79
400	7	16	424	-	-	-	39	30	422	-	-	-	85	28	421	-	-	-	85
450	17	38	470	-	-	-	34	26	476	-	-	-	65	21	473	-	-	-	67
500	12	27	529	-	-	-	36	27	523	-	-	-	56	18	525	-	-	-	75
550	6	13	579	-	-	-	11	8	565	-	-	-	19	6	570	-	-	-	65
600	-	-	-	-	-	-	-	-	-	-	-	-	1	0	611	-	-	-	-
TOTAL	45						131						309						
MEAN			487	-	-	-			473	-	-	-			443	-	-	-	74

Appendix 3. Biological data by length interval for Arctic charr live sampled and released in the Rat River, 1983.

LENGTH INTERVAL (MM)	MALES N	MALES %	MALES LENGTH(MM) MEAN	MALES WEIGHT(G) MEAN	MALES WEIGHT(G) SD	MALES K	FEMALES N	FEMALES %	FEMALES LENGTH(MM) MEAN	FEMALES WEIGHT(G) MEAN	FEMALES WEIGHT(G) SD	FEMALES K	COMBINED N	COMBINED %	COMBINED LENGTH(MM) MEAN	COMBINED WEIGHT(G) MEAN	COMBINED WEIGHT(G) SD	COMBINED K	% FEMALE
250	-	-	-	-	-	-	1	0	285	-	-	-	39	6	292	-	-	-	-
300	-	-	-	-	-	-	4	2	319	-	-	-	229	38	319	-	-	-	-
350	6	11	394	-	-	-	17	8	386	-	-	-	48	8	381	-	-	-	74
400	17	32	421	-	-	-	78	36	420	-	-	-	130	21	420	-	-	-	82
450	12	23	468	-	-	-	53	25	473	-	-	-	71	12	471	-	-	-	82
500	11	21	515	-	-	-	42	19	520	-	-	-	59	10	519	-	-	-	79
550	6	11	568	-	-	-	20	9	561	-	-	-	28	5	563	-	-	-	77
600	1	2	620	-	-	-	1	0	605	-	-	-	2	0	613	-	-	-	50
TOTAL	53						216						606						
MEAN			469	-	-	-			461	-	-	-			393	-	-	-	80

Appendix 4. Biological data by length interval for Arctic charr dead sampled from the Rat River, 1983.

LENGTH INTERVAL (MM)	MALES						FEMALES						COMBINED					
		LENGTH(MM)	WEIGHT(G)			%		LENGTH(MM)	WEIGHT(G)			%		LENGTH(MM)	WEIGHT(G)			%
	N	MEAN	MEAN	SD	K	MAT	N	MEAN	MEAN	SD	K	MAT	N	MEAN	MEAN	SD	K	MAT
250	1	298	255	-	0.96	0	4	296	274	40	1.05	0	5	297	270	36	1.03	0
300	3	328	404	20	1.15	33	12	318	370	96	1.13	0	15	320	376	86	1.13	7
350	-	-	-	-	-	-	8	377	600	96	1.11	50	8	377	600	96	1.11	50
400	3	411	683	161	0.98	67	15	427	847	97	1.09	93	18	424	819	121	1.07	89
450	2	477	1150	71	1.06	100	21	476	1222	201	1.13	90	23	476	1216	193	1.13	91
500	2	513	1325	35	0.98	100	14	523	1489	188	1.04	100	16	521	1469	184	1.04	100
550	2	569	1950	212	1.06	100	4	568	1863	75	1.02	100	7	568	1900	112	1.03	86
600	-	-	-	-	-	-	1	619	2400	-	1.01	100	1	619	2400	-	1.01	100
TOTAL	13						79						93					
MEAN		433	951	581	1.04			438	1005	499	1.09			439	1008	515	1.09	

Appendix 5. Summary of existing harvest records for Arctic charr from the Mackenzie Delta area.

Year	Fishery	Actual wt (kg)	No. fish	Estimated wt (kg)*	Area	Source
1965	commercial	7 311	-	-	Mackenzie Delta	Corkum and McCart 1981
1966	commercial	364	-	-	Mackenzie Delta	Corkum and McCart 1981
1972	domestic and commercial	-	6 500	6 604	Rat River	Low 1973 (unpubl. data)
1972	domestic and commercial	-	8 000-12 000	8 128-12 190	Big Fish River	Low 1973 (unpubl. data)
1973	domestic and commercial	-	2 600	2 641	Rat River	Low 1973 (unpubl. data)
1973	domestic and commercial	-	4 000-	4 064	Big Fish River	Low 1973 (unpubl. data)
1973	domestic	595	-	-	Fort McPherson†	Snowshoe 1973
1978	domestic	800	-	-	Mackenzie Delta	Corkum and McCart 1981
1978	commercial	1 405	-	-	Mackenzie Delta	Corkum and McCart 1981
1979	domestic	64	-	-	Mackenzie Delta	Corkum and McCart 1981
1979	commercial	131	-	-	Mackenzie Delta	Corkum and McCart 1981
1980	domestic	1 958	-	-	Mackenzie Delta	Corkum and McCart 1981
1980	commercial	6 215	-	-	Mackenzie Delta	Corkum and McCart 1981
1980	domestic	784	-	-	Fort McPherson††	Krutko (unpubl. data)

* Mean weight from 1983 was used to estimate the total harvest by weight for previous surveys.
† Possibly included in Corkum and McCart's 1973 domestic harvest figures.
†† Possibly included in Corkum and McCart's 1980 domestic harvest figures.